

## **SINGLE-FREQUENCY NARROW LINEWIDTH 2 $\mu$ M FIBER LASER**

### ABSTRACT OF THE INVENTION

5        A compact single frequency, single-mode 2 $\mu$ m fiber laser  
with narrow linewidth, <100 kHz and preferably < 100 kHz, is  
formed with a low phonon energy glass doped with triply  
ionized rare-earth thulium and/or holmium oxide and fiber  
gratings formed in sections of passive silica fiber and  
10 fused thereto. Formation of the gratings in passive silica  
fiber both facilitates splicing to other optical components  
and reduces noise thus improving linewidth. An increased  
doping concentration of 0.5 to 15 wt. % for thulium, holmium  
or mixtures thereof produces adequate gain, hence output  
15 power levels for fiber lengths less than 5cm and preferably  
less than 3cm to enable single-frequency operation.